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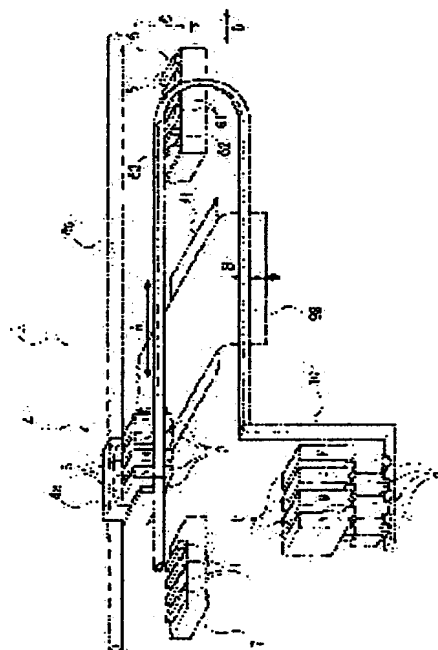
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(54) INKJET PRINTER

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent the color mixing among recording heads during a maintenance work.

SOLUTION: The inkjet printer comprises a recording head 2 having an ejection face with an array of a plurality of ejection openings each ejecting ink of one color, a cap member 61 being applied to the ejection face to cover the plurality of ejection openings, and a suction pump 64 sucking ink from the plurality of ejection openings through the cap member 61. The inkjet printer 1 is provided with a plurality of recording heads 2 ejecting ink of two or more different colors and provided with the cap members 61 of the same number as that of the color inks being ejected from the plurality of recording heads 2.



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CLAIMS

[Claim(s)]

[Claim 1]

It is the ink jet printer which breathes out ink to a record medium and records an image on a record medium,

The recording head which has the regurgitation side where two or more deliveries which carry out the regurgitation of the ink of the color of 1 were located in a line,

The cap member which arrives at said regurgitation side so that said two or more deliveries may be covered,

The suction pump which attracts ink from said two or more deliveries through said cap member, Preparation,

The ink jet printer characterized by preparing only the same number as the color number of the ink in which the ink of two or more mutually different colors is breathed out from said recording head of these plurality while two or more said recording heads are prepared, and said cap member is breathed out from said two or more recording heads.

[Claim 2]

In an ink jet printer according to claim 1,

The ink jet printer characterized by using said ink as the hyperviscous ink whose viscosity in 30 degrees C is 10 or more mPa-s.

[Claim 3]

In an ink jet printer according to claim 1 or 2,

While having a heating means to heat said ink breathed out from said recording head, the viscosity in 30 degrees C uses said ink as hyperviscous 10 or more mPa-s ink which is 500 or less mPa-s,

The ink jet printer characterized by being UV hardening method which ultraviolet rays are irradiated [method] at the ink which reached the target on the record medium which heats said ink with said heating means at 30 degrees C or more 150 degrees C or less, is breathed out from said recording head, and does not have ink absorptivity, and stiffens this ink.

[Claim 4]

In an ink jet printer given in any 1 term of claims 1-3,

The ink jet printer characterized by the discharge quantity from said delivery being 2 or more pls [per dot] 20 or less pl.

[Claim 5]

In an ink jet printer given in any 1 term of claims 1-4,

Said cap member,

The ink jet printer characterized by filling the relation whose degree of hardness H (JISA) it is an elastic body and is 20 degree <=(degree of hardness H) <=100 degree.

[Claim 6]

In an ink jet printer given in any 1 term of claims 1-5,

When two or more said cap members are prepared according to the color number of said ink breathed

out from said two or more recording heads,

The ink jet printer characterized by connecting said every one suction pump to each cap member.

[Claim 7]

In an ink jet printer given in any 1 term of claims 1-5,

It has the flow conduit to which said ink attracted by said suction pump circulates,

When said ink of four colors of yellow, MAZENDA, cyanogen, and black is breathed out from said two or more recording heads,

Inside of the ink of these 4 color,

Said common flow conduit and said suction pump are applied to the ink of the two color of yellow and black,

The ink jet printer characterized by applying said flow conduit common to ink and said suction pump of cyanogen and the two color of MAZENDA.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the ink jet printer which breathes out ink to a record medium and records an image on a record medium.

[0002]

[Description of the Prior Art]

Although two or more deliveries which make ink a drop and carry out the regurgitation to the recording head of an ink jet printer are prepared, all of the delivery of these plurality are prepared in the same field (henceforth a "regurgitation side"). In this recording head, whenever it records the image of a predetermined number, the ink in a recording head is usually attracted with an attraction means, and it is maintaining. It specifically draws in with a suction pump through this attraction cap a bonnet and after that so that the regurgitation side of a recording head may be sealed with an attraction cap, and the blinding by air bubbles or dust generated in the passage leading to the blinding or the delivery by buildup of the viscosity of ink or fixing of ink is recovered.

[0003]

[Problem(s) to be Solved by the Invention]

By the way, when recording a full color image on a record medium, two or more recording heads which carry out the regurgitation of the ink of a color which is usually mutually different are prepared in the body of a printer. In this case, although ink is attracted from the delivery of each recording head as above-mentioned at the time of a maintenance, if the same attraction cap is diverted over two or more recording heads which carry out the regurgitation of the ink of a mutually different color, the ink which remained in the attraction cap adheres to the regurgitation side of the recording head which carries out the regurgitation of the ink of a different color from this, and the ink of mutually different colors may carry out color mixture. In this case, the ink of a desired color will not be breathed out by the record medium from each recording head, but the debasement of an image will be caused.

[0004]

The technical problem of this invention is offering the ink jet printer which prevents the color mixture of the ink between each recording head at the time of a maintenance.

[0005]

[Means for Solving the Problem]

In order to solve the above-mentioned technical problem, it is invention according to claim 1, It is the ink jet printer which breathes out ink to a record medium and records an image on a record medium,

The recording head which has the regurgitation side where two or more deliveries which carry out the regurgitation of the ink of the color of 1 were located in a line,

The cap member which arrives at said regurgitation side so that said two or more deliveries may be covered,

The suction pump which attracts ink from said two or more deliveries through said cap member,
Preparation,

While two or more said recording heads are prepared, the ink of two or more mutually different colors is breathed out from said recording head of these plurality, and it is characterized by preparing only the same number as the color number of the ink in which said cap member is breathed out from said two or more recording heads.

[0006]

In invention according to claim 1, since only the number as the color number of the ink breathed out from two or more recording heads with the same cap member is prepared, the ink of a color in which each recording heads differ mutually can be treated as the whole discharge recording head as a cap member of the dedication corresponding to each color for each cap member, in case the regurgitation of the ink of two or more colors is carried out. In this case, since ink can be attracted with a suction pump using a different cap member for every color breathed out from two or more recording heads, the color mixture of the ink between each recording head can be prevented. In addition, in invention according to claim 1, when carrying out the regurgitation of the ink of the same color from two or more recording heads, by preparing a separate cap member for every recording head, there is nothing and the mind of applying the same cap member to the recording head which carries out the regurgitation of the ink of the same color is contained.

[0007]

Invention according to claim 2 is set to an ink jet printer according to claim 1,

It is characterized by using said ink as the hyperviscous ink whose viscosity in 30 degrees C is 10 or more mPa-s.

[0008]

In the hyperviscous ink whose viscosity [in / in the problems which this invention tends to solve / 30 degrees C] is 10 or more mPa-s, since it is remarkable, the effectiveness which applies this invention increases in the hyperviscous ink whose viscosity in 30 degrees C is 10 or more mPa-s.

[0009]

Invention according to claim 3 is set to an ink jet printer according to claim 1 or 2,

While having a heating means to heat said ink breathed out from said recording head, the viscosity in 30 degrees C uses said ink as hyperviscous 10 or more mPa-s ink which is 500 or less mPa-s,

It is characterized by being UV hardening method which ultraviolet rays are irradiated [method] at the ink which reached the target on the record medium which heats said ink with said heating means at 30 degrees C or more 150 degrees C or less, is breathed out from said recording head, and does not have ink absorptivity, and stiffens this ink.

[0010]

Since UV hardening is carried out using hyperviscous ink, while being able to fix ink also on a record medium without ink absorptivity according to invention according to claim 3, by work of a heating means etc., the regurgitation of the ink from a recording head is made good, and record of an image can be performed.

[0011]

Invention according to claim 4 is set to an ink jet printer given in any 1 term of claims 1-3,

It is characterized by the discharge quantity from said delivery being 2 or more pls [per dot] 20 or less pl.

[0012]

According to invention according to claim 4, while the discharge quantity from a delivery can form 2 or more pls [per dot] 20 or less pl, and image quality high definition at a small drop, even if it is the printer of a small drop specification, by work of a heating means etc., the regurgitation of the ink from a delivery is made good and record of an image can be performed.

[0013]

Invention according to claim 5 is set to an ink jet printer given in any 1 term of claims 1-4,
Said cap member,

It is characterized by filling the relation whose degree of hardness H (JISA) it is an elastic body and is 20 degree \leq (degree of hardness H) \leq 100 degree.

[0014]

In invention according to claim 5, since a cap member is the elastic body which arrives at the regurgitation side of a recording head, when a cap member can be arrived at the regurgitation side of a recording head, a cap member is stuck to a regurgitation side, carrying out elastic deformation. Thereby, the leakage in attraction can be prevented between a cap member and a regurgitation side, therefore ink can be attracted in homogeneity and efficiently from two or more deliveries of a recording head. In addition, about "a degree of hardness H", it mentions later.

[0015]

Invention according to claim 6 is set to an ink jet printer given in any 1 term of claims 1-5, When two or more said cap members are prepared according to the color number of said ink breathed out from said two or more recording heads,

It is characterized by connecting said every one suction pump to each cap member.

[0016]

In invention according to claim 6, when two or more cap members are prepared, since one suction pump is connected at a time, to each cap member, ink can be attracted with a separate suction pump for every color of the ink breathed out from each recording head.

[0017]

Invention according to claim 7 is set to an ink jet printer given in any 1 term of claims 1-5,

It has the flow conduit to which said ink attracted by said suction pump circulates,

When said ink of four colors of yellow, MAZENDA, cyanogen, and black is breathed out from said two or more recording heads,

Inside of the ink of these 4 color,

Said common flow conduit and said suction pump are applied to the ink of the two color of yellow and black,

It is characterized by applying said common flow conduit and said suction pump to the ink of cyanogen and the two color of MAZENDA.

[0018]

In invention according to claim 7, the ink of four colors of yellow, MAZENDA, cyanogen, and black is breathed out from two or more recording heads. By the way, viscosity may change for every color with factors, such as the content of a presentation of a constituent, temperature, and pH, about the ink breathed out from a recording head. In this case, the viscosity of the ink of the four above-mentioned color under this ***** becomes small in order of black, cyanogen, MAZENDA, and yellow, and its viscosity of the ink of yellow is [the viscosity of the ink of black is the largest and] the smallest.

Therefore, if the ink of these 4 color is attracted with the same suction force, since the passage resistance at the time of ink with larger viscosity circulating a flow conduit cannot circulate a flow conduit easily greatly, the attraction function according to a suction pump in ink with larger viscosity falls.

[0019]

Since according to invention according to claim 7 a common flow conduit and a common suction pump are applied to black with the largest viscosity, and the ink of yellow with the smallest viscosity under this ***** and a common flow conduit and a common suction pump are applied also to the cyanogen possessing the viscosity between black and yellow, and the ink of MAZENDA here, the passage resistance difference between each ink at the time of each ink circulating a flow conduit is reducible. Thereby, a suction force prevents the phenomenon in which ink cannot fully be small attracted depending on ink, and can attract the ink of each color efficiently.

[0020]

[Embodiment of the Invention]

Hereafter, the operation gestalt concerning the ink jet printer (only henceforth a "printer") of this invention is explained with reference to a drawing. However, the range of this invention is not limited to the example of a graphic display. Drawing 1 is the perspective view showing the important section of a

printer 1. Drawing 2 is the front view of a printer 1.

[0021]

In addition, by making ink into a drop, towards the recording surface of a record medium 99, the printer 1 concerning this operation gestalt is irradiating light to the field which the ink droplet's reached among record media 99, and records an image on a record medium 99 discharge and after that. "Ink" here is ink which has low viscosity as it has and heats high viscosity in ordinary temperature, and the viscosity V in 30 degrees C is the mind of the ink of 40 - 500 mPa-s preferably ten to 500 mPa-s. In less than 10 mPa-s, since it is easy to permeate the record media 99, such as the recording paper, clear record cannot be performed. Moreover, if 500 mPa-s is exceeded, the smooth nature of image quality will be lost. Furthermore, the viscosity in 60 degrees C of this ink is 3 - 20 mPa-s preferably three to 30 mPa-s. In less than 3 mPa-s, when a possibility of producing nonconformity is in the high-speed regurgitation from the recording head 2 mentioned later and 30 mPa-s is exceeded, there is a possibility that dischargeability may deteriorate. Moreover, when breathed out from the recording head which especially consists of a piezo-electric element, as for this ink, it is desirable that viscosity is the liquid of 3 - 30 mPa-s. In addition, the viscosity of this ink was measured in the viscosity-measuring method of the liquid specified to JIS Z 8803, and used rotational viscometer (screw trowel star) type VT07 made from HAAKE L for measurement of actual viscosity. Furthermore, "ink" here is the mind also possessing the property hardened by the irradiation of light of ink. About "light" here, it mentions later.

[0022]

Moreover, you may be the record medium in which what consists of construction material in which image recording is possible by the printer 1 of the product made of paper, the product made of resin, or others is applicable, and no ink absorptivity is as "a record medium 99" concerning this operation gestalt in addition to the good record medium (for example, record medium made of paper) of ink absorptivity, or the low record medium of ink absorptivity. "A record medium without ink absorptivity or the low record medium of ink absorptivity" is a record medium which has the surface layer (recording layer) which consists of the record medium formed from the ingredient without ink absorptivity, or the low ingredient of ink absorptivity, an ingredient without ink absorptivity, or a low ingredient of ink absorptivity. As "an ingredient without ink absorptivity, or a low ingredient of ink absorptivity", various plastics metallurgy groups etc. are mentioned, for example.

[0023]

Four recording heads 2 and 2 and -- to which a printer 1 carries out the regurgitation of the ink droplet to a record medium 99 as the basic configuration as shown in drawing 1, Four sub tanks 3 and 3 and -- which supply ink to each recording head 2, The carriage device 4 equipped with movable carriage 4a along a main scanning direction A, The maintenance unit 6 which maintains each recording head 2, and the home position 7 where the carriage 4 of an intact condition stands by, Four Maine tanks 8 and 8 which store the ink of each color, --, four booster pumps 9 and 9 connected to each Maine tank 8 and --, The ink feed zone material 10 which supplies ink to each sub tank 3 from each Maine tank 8, The platen 11 which carries out attraction maintenance of the non-recording surface of a record medium 99, and the delivery device in which a record medium 99 is sent out in the direction B of vertical scanning (graphic display abbreviation), An exposure means (graphic display abbreviation) to irradiate light, and the control unit (graphic display abbreviation) which controls the temperature of the ink in each recording head 2 are provided in the record medium 99 to which ink adhered.

[0024]

A delivery device is equipped with a delivery motor, a delivery roller, etc. of graphic display abbreviation, and has the function to send out a record medium 99 in the direction B of vertical scanning by actuation of said delivery motor. Concretely, to compensate for the actuation of carriage 4a mentioned later, a delivery device sends out a record medium 99 intermittently, that is, repeats the send of a record medium 99, and a halt.

[0025]

A platen 11 carries out attraction maintenance of the non-recording surface of the record medium 99 conveyed in the direction B of vertical scanning. While the attraction room equipped with a fan under

the platen 11 is specifically prepared, attraction opening which consists of two or more stomata which are open for free passage in this attraction room is prepared in the background of a platen 11. It follows, and the non-recording surface of the record medium 99 on a platen 11 can be attracted by making the fan of an attraction room drive, and further, where a record medium 99 is stuck to a platen 11 by collaboration with actuation of this fan and said conveyance device, it can convey now in the direction B of vertical scanning.

[0026]

Each Maine tank 8 is an exchangeable ink cartridge, for example, and the ink of Isshiki is stored by each Maine tank 8. That is, the ink of which color of several sorts of colors is stored by one ink tank 8. Although the ink of a color different every ink tank 8 is stored fundamentally, the ink of the same color may be stored by two or more ink tanks 8 and 8 (--). As a color of the ink applied to a printer 1, there is each process color which makes a fundamental color yellow (Y), a Magenta (M), cyanogen (C), and black (K) as shown, for example in drawing 1.

[0027]

The ink feed zone material 10 is -- to four Maine tanks 8 and 8, four sub tanks 3 and 3, and a member that leads to -- for every color of ink, and supplies the ink of each color to the sub tank 3 which leads to the Maine tank 8 concerned from each Maine tank 8. This ink feed zone material 10 is formed from the flexible member so that the migration of carriage 4a mentioned later can be followed.

[0028]

Between the ink feed zone material 10, and four Maine tanks 8 and 8 and --, four booster pumps 9 and 9 and -- intervene. Each booster pump 9 is formed every Maine tank 8. Each booster pump 9 enables supply of the ink from each Maine tank 8, and supply of the ink to the sub tank 3 which leads to the Maine tank 8 concerned from each Maine tank 8 with each booster pump 9 is performed.

[0029]

Four sub tanks 3 and 3 and -- store temporarily two or more Maine tanks 8 and 8 and the ink of each color stored by --. Ink is supplied to each sub tank 3 through the ink feed zone material 10 from the Maine tank 8 which leads to the sub tank 3 concerned. Furthermore, the recording head 2 is connected to each sub tank 3, respectively, and it has the function which supplies the ink stored temporarily to a recording head 2. Moreover, each sub tank 3 is carried in carriage 4a mentioned later, and follows migration of carriage 4a.

[0030]

Four recording heads 2 and 2 and every one -- are connected to four above mentioned sub tanks 3 and 3 and above mentioned --. These four recording heads 2 and 2 and -- are carried in carriage 4a mentioned later like the sub tank 3, and follow migration of carriage 4a. And each recording head 2 carries out the regurgitation of the ink supplied from the sub tank 3 connected to the recording head 2 concerned during migration of carriage 4a to a record medium 99.

[0031]

Here, a recording head 2 is explained to a detail with reference to drawing 3. In addition, the configuration of the recording head 2 explained below is common in four recording heads 2 and 2 and --. Drawing 3 (a) is the sectional view which looked at the recording head 2 from the side face, and drawing 3 (b) is the perspective view showing the heating heater arranged in a recording head 2. The input 102 which makes the ink in which a recording head 2 is supplied from the sub tank 3 as shown in drawing 3 (a) flow in a recording head 2, The ink passage section 103 which circulates the ink which flowed from input 102, The ink room 104 which stores the ink which passed the ink passage section 103, Two or more nozzles 105 and 105, --, two or more deliveries 105a and 105a and -- that make an ink droplet the ink which passed each nozzle 105, and carry out the regurgitation, The heating heater 107 which heats the ink stored in the ink room 104, and the temperature sensor 108 which detects the temperature of the ink in the ink room 104 are provided.

[0032]

Two or more nozzles 105 and 105 and -- are prepared together with the recording head 2 only in a predetermined number (for example, 256 pieces). Two or more deliveries 105a and 105a and every one -

- are prepared to the nozzle 105 of 1, it follows and only the number same in more than and a nozzle 105 is prepared. And the deliveries 105a and 105a of these plurality and -- are located in a line with the single tier along the direction B of vertical scanning to underside 2a (field which counters a record medium 99) of a recording head 2. In addition, in the following explanation, underside 2a of a recording head 2 is called "regurgitation side 2a."

[0033]

Moreover, the heating heater 107 is a member which carries out front view, has a trapezoid configuration and has predetermined thickness as it is shown in drawing 3 (b). Two slots 107a and 107a for enlarging surface area of heating heater 107 self at this heating heater 107 are established in bilateral symmetry in drawing 3 (b), respectively. Thereby, the touch area of the heating heater 107 and the ink in the ink room 104 is enlarged, and the ink in the ink room 104 can be efficiently heated now.

[0034]

It connects with said control unit, respectively, and the above-mentioned heating heater 107 and the above-mentioned temperature sensor 108 control heating of the heating heater 107 so that said control unit makes temperature of the ink in the ink room 104 the laying temperature set up beforehand based on the detection signal detected by the temperature sensor 108. In addition, as the above "laying temperature (T)" concerning the temperature control of ink, it is desirable that it is $30\text{ degree-C} \leq (\text{laying temperature } T) \leq 150\text{ degree C}$, and it is more desirable that it is $40\text{ degree-C} \leq (\text{laying temperature } T) \leq 100\text{ degree C}$. Since the ink concerned can be supplied to a recording head 2 where the viscosity of ink is reduced if laying temperature T is set up within the limits of this, the regurgitation of the ink droplet from a recording head 2 can be stabilized. When laying temperature T is $\leq (\text{laying temperature } T) 30\text{ degree C}$ or $150\text{ degree-C} \leq (\text{laying temperature } T)$, the regurgitation of the ink droplet from a recording head 2 becomes difficult and is not desirable.

[0035]

Moreover, since viscosity is higher than water color ink generally, the ink concerning this operation gestalt has the large viscosity range of fluctuation by temperature fluctuation. Here, since the size of an ink droplet and the regurgitation rate of an ink droplet are influenced greatly and degradation of image quality is caused to them as it is, viscosity fluctuation of ink needs to keep the temperature of the ink in the liquid room 104 as constant as possible. It follows, and it is desirable to control the control width of face (temperature requirement) to said laying temperature T at $*(\text{laying temperature } T) 5\text{ degrees C}$, and it is [it is more desirable to control at $*(\text{laying temperature } T) 2\text{ degrees C}$, and] still more desirable to control at $*(\text{laying temperature } T) 1\text{ degree C}$.

[0036]

Moreover, as discharge quantity M of the ink droplet per [which is breathed out from each delivery 105a] drop, it is desirable that it is $2\text{pl} \leq (\text{discharge quantity } M) \leq 20\text{pl}$, it is more desirable that it is $2\text{pl} \leq (\text{discharge quantity } M) \leq 10\text{pl}$, and it is still more desirable that it is $4\text{pl} \leq (\text{discharge quantity } M) \leq 7\text{pl}$. When discharge quantity M is 20 or more pls, highly minute printing is difficult, and it is because the concentration of the image formed in a record medium 99 becomes low in being 2 or less pls.

Moreover, as the drop diameter D of a dot of the ink droplet which reached the record medium 99, i.e., a diameter, it is desirable that it is $50\text{micrometer} \leq (\text{diameter } D \text{ of dot}) \leq 200\text{micrometer}$, it is more desirable that it is $50\text{micrometer} \leq (\text{diameter } D \text{ of dot}) \leq 150\text{micrometer}$, and it is still more desirable that it is $55\text{micrometer} \leq (\text{diameter } D \text{ of dot}) \leq 100\text{micrometer}$. When the diameter of a dot is 50 micrometers or less, the concentration of the image formed in a record medium 99 becomes low, and it is because highly minute printing is difficult when it is 200 micrometers or more.

[0037]

In addition, although not illustrated with this operation gestalt, as driving force of the ink regurgitation in each recording head 2, the applicability over ink is wide, and the method using a piezo-electric operation of the piezo electric crystal in which the high-speed regurgitation is possible is desirable. It is an ink jet head method which an electrode layer is concretely formed in the interior of the detailed slot formed on the piezoelectric base, and is further covered by the insulator layer and forms ink passage.

[0038]

Four recording heads 2 and 2 and -- which mentioned the carriage device 4 above and four subtasks 3 and 3, and carriage 4a which carried --, Guide member 4b which extends along a main scanning direction A and guides migration to the main scanning direction A of carriage 4a, The conveyance belt (graphic display abbreviation) to which carriage 4a is moved where carriage 4a is supported, and the conveyance motor (graphic display abbreviation) used as the driving source of migration of carriage 4a are provided. In this carriage device 4, if said conveyance motor drives, said conveyance belt will operate, and carriage 4a moves along a main scanning direction A in the condition of having been guided to guide member 4b. In addition, the migration direction of carriage 4a is changed according to the hand of cut of said conveyance motor. Specifically, carriage 4a is ****, double action, or a thing that carries out both-way migration in a main scanning direction A, when both-way migration is carried out along with guide member 4b in a main scanning direction A according to the send of the intermittent record medium 99 and the record medium 99 has still more specifically stopped.

[0039]

Although an exposure means is not illustrated, by irradiating light to the record medium 99 sent out in the direction B of vertical scanning, and irradiating light at a record medium 99, it stiffens the ink droplet adhering to a record medium 99, and fixes ink to the record medium 99 concerned. although this exposure means possesses the light source for irradiating light in a record medium 99, the light source is carried in carriage 4a so that it may be arranged along a main scanning direction A at the both sides of each recording head 2, as indicated by JP,60-132767,A -- having -- **** -- the platen 11 of the direction B of vertical scanning -- the downstream -- and it may be fixed to printer 1 body so that it may cover full [of the record medium 99 sent out in the direction B of vertical scanning].

[0040]

When it is fixed to printer 1 body so that light may be irradiated at a record medium 99 while the light source follows horizontal scanning of carriage 4a, when the light source has been arranged at the both sides of each recording head 2, the light source may be the downstream from the platen 11 of the direction B of vertical scanning and it may cross crosswise [of a record medium 99], where the light source is fixed to printer 1 body, light is irradiated at a record medium 99. In addition, after the ink droplet which was breathed out from each recording head 2 in such a configuration reaches a record medium 99, fixed time amount will be opened and light will be irradiated by the record medium 99 from the light source.

[0041]

Moreover, it replaces with the above-mentioned configuration which was indicated by above-mentioned JP,60-132767,A, is good also as a configuration using an optical fiber, and good also as a configuration which irradiates the field which the ink droplet reached among record media 99 by hitting against the mirror plane which prepared the light irradiated from the collimated light source in the side face of four recording heads 2 and 2 and the head unit which consists of --. In addition, if the light source is fixed to a printer 1 also in which the above-mentioned configuration, since the operation section for moving the light source is omissible, it can consider as a cheap configuration.

[0042]

Moreover, "light" here is the light of a wide sense, and ultraviolet rays, an electron ray, an X-ray, a visible ray, infrared radiation, etc. are included. However, when the hardenability of an ink droplet or the cost of the light source is taken into consideration, it is desirable to apply ultraviolet rays. Moreover, as the "light source" which irradiates ultraviolet rays, a mercury lamp, a metal halide lamp, an excimer lamp, ultraviolet laser, or LED (Light Emitting Diode) is applicable.

[0043]

As for the exposure of the light from the light source, it is desirable to be carried out whenever an ink droplet is breathed out from each recording head 2 (i.e., whenever the ink droplet of Isshiki is breathed out). Moreover, it is desirable to carry out two-kind (first light source and the second light source) preparation of the light source also in which the above-mentioned exposure method, and to make hardening of an ink droplet complete by the exposure of the light from the second light source. This is because it contributes to acquiring the wettability of the ink droplet of the two-color eye which reached

the record medium 99, and the adhesive property between each ink droplet, and constructing the light source cheaply.

[0044]

In addition, as for the first light source and the second light source, it is desirable to change exposure wavelength or an exposure illuminance. That is, it is desirable to make exposure energy of the first light source smaller than the exposure energy of the second light source. concrete -- the exposure energy of the first light source -- an exposure energy total amount -- it is preferably made to 1 - 5% still more preferably 1 to 10% 1 to 20%. By performing the exposure which changed the illuminance, molecular weight distribution after an ink droplet hardens will become desirable. In addition, if a high illuminance is irradiated at once according to the one light source, although the conversion of the constituent of ink will be raised, the molecular weight of the constituent (polymer) which carried out the polymerization is small, and the reinforcement of the ink droplet which reached the record medium 99 is not obtained. Like ink jet ink, remarkable effectiveness is extremely acquired by the low presentation of viscosity.

[0045]

Moreover, it is desirable to make into long wavelength wavelength of the light irradiated from the first light source rather than the wavelength of the light irradiated from the second light source. In this case, by the exposure of the light by the first light source, the surface of an ink droplet is stiffened, the blot of ink to a record medium 99 can be suppressed, by the exposure of the light by the second light source, about 99 record medium [which an exposure line cannot reach easily] ink is stiffened, and the adhesion of the ink and a record medium 99 concerned can be improved. Also in order to promote hardening inside the ink droplet which followed and reached the record medium 99, as for the exposure line wavelength of the light by the second light source, it is desirable that it is short wavelength.

[0046]

Moreover, while using the above-mentioned ink as a description of the configuration of the printer 1 concerning this operation gestalt, after an ink droplet reaches a record medium 99, it controls still more preferably after 0.01 - 0.3 seconds preferably after 0.01 - 0.5 seconds to irradiate light from the light source after 0.01 - 0.15 seconds. Thus, it can prevent that the ink droplet which reached the record medium 99 spreads in a record medium 99 before hardening by the irradiation of light by controlling the time amount from the impact to the record medium 99 of an ink droplet to the exposure of the light by the light source to ultrashort time amount. Moreover, since it can expose to the depths which the light from the light source does not reach before the ink droplet which reached the target permeates a record medium 99 when the porosity record medium 99 is applied, the residual of an unreacted monomer can be suppressed and an odor can be reduced. This can acquire the big synergistic effect by using the ink concerning this operation gestalt, and if the viscosity of the ink in 25 degrees C uses the ink of 35 - 500 mPa-s especially, it can acquire big effectiveness. That is, by applying such a configuration, also to various record media 99 with which surface wettability differs, the diameter of a dot of the ink droplet which reached the target can be kept constant, and image quality improves.

[0047]

In addition, in case the image of a color is recorded on a record medium 99, it is desirable to pile up sequentially from the ink of the low color of lightness. It is because the exposure line from the light source cannot reach easily even to the ink of the lower part of the high color of lightness and it will be easy to produce inhibition of hardening sensibility, the increment in a residual monomer, generating of an odor, degradation of the adhesion between each ink droplet, etc., if the ink of the low color of lightness is piled up on the ink of the high color of lightness. Moreover, although it is also possible to expose collectively about the exposure of the light from the light source after breathing out the ink droplet of a total color from each recording head 2, the direction exposed whenever it carries out the regurgitation of the ink droplet of Isshiki is desirable in the viewpoint of promoting hardening of an ink droplet.

[0048]

Moreover, it is desirable about two or more recording heads 2 and 2 and -- to make between each recording head 2 into exposure line permeability substantially. It is desirable to apply the configuration

which between each recording head 2 is constituted [configuration] from a member of exposure line permeability, or does not specifically arrange a member. By applying such an easy configuration, immediately after an ink droplet reaches a record medium 99 for every color irradiating light promptly -- possible -- especially -- blot prevention of a secondary color, and bidirectional printing (the record which breathes out an ink droplet and forms an image among reciprocation of carriage 4a during migration of the direction of an outward trip, and the direction of a return trip --) It sets and the blot difference of the dot of record by outward trip migration of carriage 4a and record by return trip migration can be prevented (it prevents the colors recorded by record by outward trip migration of carriage 4a and record by return trip migration differing).

[0049]

The maintenance unit 6 is the member prepared in the migration edge of carriage 4a as it is shown in drawing 1 and drawing 2. two or more deliveries 105 and 105 of each recording head 2, and -- (refer to drawing 3 (a)) -- a wrap -- with four attraction caps 61 and 61 which arrive at regurgitation side 2a of each recording head 2 like, and -- A recovery means 62 to collect the ink by which air ejecting was carried out from each recording head 2, wiper member [which removes the ink which remains in regurgitation side 2a of each recording head 2] 63, rise-and-fall means [to make it go up and down maintenance unit 6 the very thing up and down along the direction of arrow-head C] (graphic display abbreviation), and maintenance unit 6 the very thing -- the direction of arrow-head D (the same direction as a main scanning direction A --) It meets and the migration means (graphic display abbreviation) to which it is made to move is provided.

[0050]

Along the main scanning direction A, four attraction caps 61 and 61 and -- are located in a line, and are prepared. Every one suction pump 64 is formed in each attraction cap 61. These four suction pumps 64 and 64 and -- generate the suction force at the time of attracting ink from the deliveries 105a and 105a of each recording head 2, and --. Moreover, every one flow conduit 66 which forms the negotiation way of ink where the suction pump 64 of 1 is minded is connected to each attraction cap 61. The reservoir tank 65 for storing the ink attracted from each recording head 2 is connected to these four flow conduits 66 and 66 and --.

[0051]

And if ink is simultaneously attracted from each recording head 2 by each attraction cap 61 operating four suction pumps 64 and 64 and -- in four recording heads 2 and 2 and the condition of -- of having arranged to directly under, respectively, the attracted ink will circulate each flow conduit 66, and will be stored by the reservoir tank 65. In addition, about four suction pumps 64 and 64 and --, the pressure for generating a suction force can be changed now every suction pump 64, respectively.

[0052]

Drawing 4 is the perspective view showing the attraction cap 61. In addition, the configuration of the attraction cap 61 explained below is common in four attraction caps 61 and 61 and --. The attraction cap 61 is a member which arrives at regurgitation side 2a of a recording head 2 soon, and has all the deliveries 105a and 105a of a recording head 2, and the hollow of the shape of an abbreviation rectangular parallelepiped of extent which can cover --. This attraction cap 61 fills the relation whose degree of hardness H (JISA) it is an elastic body and is $20 \text{ degree} \leq (\text{degree of hardness H}) \leq 100 \text{ degree}$. It follows, and where the attraction cap 61 is stuck to regurgitation side 2a of a recording head 2, the attraction cap 61 is stuck to regurgitation side 2a of a recording head 2, carrying out elastic deformation, where -- is covered, all the deliveries 105a and 105a of a recording head 2, and. Moreover, attraction opening 61b which leads to the suction pump 64 mentioned above is prepared in the abbreviation center section of the attraction cap 61, and ink can be attracted now from this attraction opening 61b by operating a suction pump 64. By applying such a configuration, the leakage in attraction between the attraction cap 61 and regurgitation side 2a of a recording head 2 can be prevented, as a result ink can be attracted homogeneity-wise and efficiently from each delivery 105a of a recording head 2.

[0053]

In addition, shaping of attraction cap 61 the very thing becomes it difficult that a degree of hardness H is less than 20 degrees about the attraction cap 61. Moreover, if a degree of hardness H exceeds 100 degrees, in case the attraction cap 61 is stuck to regurgitation side 2a of a recording head 2, elastic deformation is not carried out flexibly, but between the attraction cap 61 and regurgitation side 2a, a clearance may be generated, the leakage in attraction may occur and the attraction function of ink may be reduced. Therefore, the attraction cap 61 is fabricated so that the above-mentioned degree of hardness H may be provided.

[0054]

Moreover, various rubber ingredients, thermoplastic elastomer and a rubber ingredient, and the various ingredients that have the same property with an "elastic body" here are included widely. For example, independent or the thing used together may be used for various rubber ingredients, a resin ingredient, thermoplastic elastomer, etc. In this case, various rubber ingredients are not limited and the liquefied reaction hardened material which is made to harden a liquefied viscoelastic body besides a solid rubber ingredient, for example, is obtained may be used. With "a solid rubber ingredient", for example, an ethylene propylene ternary polymerization object (EPDM), Isobutylene isoprene rubber, a polyisobutylene, ethylene propylene rubber, chloroprene rubber, Independent or the polymer used together and used is received in natural rubber, styrene butadiene rubber, butadiene rubber, styrene-isoprene-styrene, styrene-styrene butadiene rubber, polyurethane rubber, etc. Combination chemicals, such as the vulcanizing agent and cross linking agent which are used in general rubber industry from the former, a vulcanization accelerator, a vulcanization acceleration assistant, a tackifier, a bulking agent, a plasticizer, an antioxidant, and a solvent, are blended, and what was vulcanized (or bridge formation) is contained. "Vulcanization" is not limited to sulfur vulcanization and bridge formation by various cross linking agents, such as organic peroxide used for general rubber industry, a metallic oxide, and an organic multiple-valued amine, is also included. With "a liquefied viscoelastic body", urethane, liquid polybutadiene, denaturation silicon, silicon, polysulfide, etc. are contained. As for these ingredients, it is desirable to carry out specified quantity addition, to mix, to carry out reaction hardening, and to use the curing agent for making it solidify.

[0055]

The wiper member 63 is the same as the distance between delivery 105a of two or more deliveries 105a and 105a established in each recording head 2, and the both ends of -- which meet in the direction B of vertical scanning inside, and 105a, or is a tabular member longer than it. This wiper member 63 is arranged so that the die-length direction of self and the direction B of vertical scanning may be in agreement. Furthermore, this wiper member 63 is an elastic body which has the same degree of hardness H as the above-mentioned attraction cap 61, and consists of one of above-mentioned ingredients. It follows, and when having arranged the upper bed section of the wiper member 63 in the location a little higher than regurgitation side 2a of a recording head 2 and moving either [at least] the maintenance unit 6 or the recording head 2, the wiper member 63 removes the ink which remained to regurgitation side 2a as ground regurgitation side 2a, carrying out elastic deformation. In addition, the wiper member 63 may be replaced with an elastic body, and you may constitute from a brush-like member.

[0056]

The maintenance unit 6 possessing the above configuration prevents four above-mentioned attraction caps 61 and 61, --, generating of air bubbles [in / four suction pumps 64 and 64, --, by providing the recovery means 62 and wiper member 63 grade / each delivery of each recording head 2], blinding, etc., and removes the residual of ink etc. further. Namely, with this maintenance unit 6, the discharge condition of the ink droplet from each delivery 105a can be maintained in the good condition, as a result a clear image can be recorded now on a record medium 99.

[0057]

A home position 7 is the migration edge of carriage 4a, and is established in the opposite hand in the maintenance unit 6 as it is shown in drawing 1 and drawing 2 . When four recording heads 2 and 2, --, carriage 4a, etc. are not concerned with record actuation, four recording heads 2 and 2, --, carriage 4a stand by at this home position 7. Four moisturization caps 71 and 71 and -- are prepared in the home

position 7. Only the number as the recording head 2 carried in carriage 4a with same these four moisturization caps 71 and 71 and -- is prepared. Each moisturization cap 71 has size, a configuration, etc. corresponding to the lower part of each recording head 2 so that the lower part of each recording head 2 can be covered, and it moisturizes the ink concerning each recording head 2. In addition, when four recording heads 2 and 2, --, carriage 4a, etc. are in a standby condition, carriage 4a is located in a home position 7, and moisturization of the ink which each recording head 2 is covered with each moisturization cap 71, and requires it for each recording head 2 is performed. Thereby, the regurgitation of the ink droplet from each recording head 2 can be performed good during record actuation.

[0058]

Next, actuation of each part material under record actuation of the printer 1 possessing the above-mentioned configuration is explained.

By the fan of a delivery device and a platen 11 operating during record actuation of a printer 1, a record medium 99 is intermittently sent out to a platen 11 along the direction B of vertical scanning one by one, where attraction maintenance is carried out. Here, when a record medium 99 stops, carriage 4a moves right above [of a record medium 99] along a main scanning direction A because the carriage device 4 operates. And an ink droplet is breathed out towards a record medium 99 by the midst to which carriage 4a moves right above [of a record medium 99] from each recording head 2. That is, each recording head 2 carries out the regurgitation of the ink droplet toward a record medium 99, moving along a main scanning direction A in the inside of a record section (refer to drawing 2). The breathed-out ink droplet reaches the target on a record medium 99. Then, the field which the ink droplet reached among record media 99 passes directly under the light source of said exposure means. At this time, light is irradiated from said light source and the ink droplet which reached the record medium 99 is hardened. And sequential record of the desired image is carried out at a record medium 99 because a printer 1 repeats such actuation.

[0059]

Henceforth, above-mentioned record actuation is performed repeatedly and an image is recorded on two or more record media 99 and 99 and -- one by one. Here, whenever the image of a predetermined number is recorded, each recording head 2 is maintained with the maintenance unit 6. If it explains in detail, after record of the image of a predetermined number will be completed, from a record section, carriage 4a moves to a maintenance field (refer to drawing 2), and stops. In addition, the maintenance unit 6 is in the condition of having descended, in this case, and it is located in the location where the wiper member 63 does not bar migration of each recording head 2.

[0060]

And first, the maintenance unit 6 moves along the direction of arrow-head D with said migration means so that four attraction caps 61 and 61 of the maintenance unit 6 and -- may counter four recording heads 2 and 2 and --, respectively. The maintenance unit 6 goes up along the direction of arrow-head C in this location with said rise-and-fall means. Thereby, four attraction caps 61 and 61 and -- stick to four recording heads 2 and 2 and regurgitation side 2a of --, and after that, four suction pumps 64 and 64 and -- operate simultaneously, and attract ink simultaneous [these four recording heads 2 and 2 and --] from each delivery 105a. Termination of attraction of ink drops the maintenance unit 6 along the direction of arrow-head C with said rise-and-fall means.

[0061]

Subsequently, the maintenance unit 6 moves in the direction of arrow-head D with said migration means so that it may be located in the location where the wiper member 63 shifted a little rather than the recording head 2 of an edge and the location which counters of four recording heads 2 and 2 and --. If the maintenance unit 6 arrives at a desired location, the maintenance unit 6 will go up along the direction of arrow-head C with said rise-and-fall means. At this time, the upper bed section of the wiper member 63 projects in a location higher than regurgitation side 2a of a recording head 2.

[0062]

And in this condition, the maintenance unit 6 moves along the direction of arrow-head D with said migration means. At this time, with migration of the maintenance unit 6, while the wiper member 63

carries out elastic deformation, it moves so that regurgitation side 2a of each recording head 2 may be ground. This removes the ink adhering to regurgitation side 2a of each recording head 2. And termination of cleaning of four recording heads 2 and 2 by the wiper member 63 and each regurgitation side 2a of -- drops the maintenance unit 6 along the direction of arrow-head C with said rise-and-fall means.

[0063]

Then, the maintenance unit 6 moves along the direction of arrow-head D with said migration means so that the recovery means 62 of the maintenance unit 6 may be located directly under the recording head 2 of an edge among four recording heads 2 and 2 and --. Subsequently, the maintenance unit 6 goes up along the direction of arrow-head C with said rise-and-fall means, and air ejecting is carried out toward the recovery means 62 from the recording head 2 which counters the recovery means 62. The maintenance unit 6 descends along the direction of arrow-head C after air ejecting termination with said rise-and-fall means. Then, similarly, while the maintenance unit 6 repeats migration and rise and fall with a migration means and a rise-and-fall means, air ejecting is performed toward the sequential recovery means 62 from the three remaining recording heads 2, 2, and 2.

[0064]

And termination of all the recording heads 2 and 2 and the air ejecting from -- terminates the maintenance of each recording head 2 by the maintenance unit 6. After the maintenance of each recording head 2 is completed, carriage 4a moves into a record section from a maintenance field, and the above-mentioned record actuation is performed. In addition, after record of all images is completed, carriage 4a moves to a home-position field (refer to drawing 2), stands by at a home position 7, and moisturizes the ink of each recording head 2 by four moisturization caps 71 and 71 and --.

[0065]

As mentioned above, by the printer 1 concerning this operation gestalt, four attraction caps 61 of the maintenance unit 6 are formed according to the color number (that is, four colors of Y, M, C, and K) of the ink breathed out from four recording heads 2 and 2 and --. And four attraction caps 61 and 61 and -- are stuck to four recording heads 2 and 2 and each regurgitation side 2a of --, and ink is attracted from each recording head 2. Here, with this operation gestalt, regurgitation side 2a of the recording head 2 which carries out the regurgitation of the ink of a color in which the attraction caps 61 of 1 differ mutually is not contacted, and each attraction cap 61 can be treated as a cap member of the dedication corresponding to the color of the ink breathed out from each recording head 2. Therefore, the color mixture of the ink between each recording head 2 at the time of a maintenance can be prevented.

Moreover, record of the image after a maintenance is made to a more exact thing in this case, as a result record of the image of high quality can be maintained over a long period of time.

[0066]

In addition, this invention may change a design into various amelioration lists in the range which does not deviate from the main point of this invention, without being limited to the above-mentioned operation gestalt. For example, with this operation gestalt, although it is the configuration for which the maintenance unit 6 whole is moved along the direction of arrow-head D at the time of a maintenance where each recording head 2 and carriage 4a are fixed to a maintenance field, you may make it the configuration to which carriage 4a is moved in a maintenance field, and may make it the configuration to which both carriage 4a and the maintenance unit 6 are moved. In this case, you need to make it go up and down the maintenance unit 6 suitably to predetermined timing in consideration of the physical relationship of each recording head 2, and the four attraction caps 61 and 61 of the maintenance unit 6, - - and the recovery means 62 and the wiper member 63.

[0067]

Moreover, although cleaning of regurgitation side 2a of each recording head 2 according to the wiper member 63 at this operation gestalt has illustrated the configuration performed after four attraction caps 61 and 61 and the ink attraction by --, it is good before ink attraction also as a configuration which cleans regurgitation side 2a of each recording head 2 by the wiper member 63.

[0068]

Moreover, although it is considered as the configuration which carries out the regurgitation of four recording heads 2 and 2 and each process color ink of the color which changes mutually with -- with this operation gestalt as shown in drawing 1. In addition to each above-mentioned process color, inside [it is each above-mentioned process color] replaces with Isshiki at least. Light yellow (LY), a light Magenta (LM), light cyanogen (LC), as the configuration which carries out the regurgitation of the ink, such as light black (LK), -- good -- in addition, White -- (W), red (R), blue (B), and Green -- it is good also as a configuration which carries out the regurgitation of the ink, such as the feature (G). In this case, it is necessary to increase according to the number of the colors which apply a recording head 2, the subtank 3, the Maine tank 8, and booster pump 9 grade.

[0069]

Of course, according to the number of the colors breathed out from a recording head 2, only the same number as this also needs to form the attraction cap 61 of the maintenance unit 6. In addition, what is necessary is for there to be no need of forming the attraction cap 61 of a recording head 2 and the same number, and just to form the attraction cap 61 of only the same number as the color number breathed out from a recording head 2 in this case, in case two or more recording heads 2 and 2 and the recording heads 2 and 2 (--) of -- which carry out the regurgitation of the ink of the same color inside consist partly. And what is necessary is just to treat each attraction cap 61 as a cap member only for [each] colors according to the color of the ink breathed out from a recording head 2. Thereby, the color mixture of the ink between each recording head 2 at the time of a maintenance can be prevented. Moreover, since the attraction cap 61 is not increased by force in this case according to the number of recording heads 2 but ** can also prevent the color mixture of the ink between each recording head 2, the cost concerning duplication of the attraction cap 61 can be controlled.

[0070]

Moreover, although considered as the configuration attracted using the suction pump 64 and flow conduit 66 of 1 to the ink of 1 in the ink of each color of Y, M, C, and K with this operation gestalt, it may replace with this, a common suction pump 64 and a common flow conduit 66 may be applied to the ink of B and Y, and the suction pump 64 and flow conduit 66 of M and C common also to ink may be applied. That is, viscosity may change for every color with factors, such as the content of a presentation of a constituent, temperature, and pH, about the ink breathed out from a recording head 2. In this case, the passage resistance at the time of ink with larger viscosity circulating a flow conduit 66 cannot circulate a flow conduit 66 easily greatly. Therefore, attraction effectiveness falls that it is hard to attract ink with larger viscosity. And about the ink of four colors of Y, M, C, and K, the viscosity under this ***** becomes small in order of the ink of B, C, M, and Y, and the viscosity of the ink of Y is [the viscosity of the ink of B is the largest and] the smallest. Therefore, by applying a suction pump 64 and a flow conduit 66 common to the ink of B and Y, and the ink of C and M, the passage resistance difference between the ink of each color of Y, M, C, and K is cut down, and the ink of each color can be attracted efficiently. In this case, the cost which does not increase a suction pump 64 according to the color number of ink, but starts duplication of the attraction cap 64 since ** is also good can be controlled.

[0071]

In addition, in addition to each process color of Y, M, C, and K, even if there are few each process colors of Y, M, C, and K, it replaces with Isshiki. Also when applying the ink of the features, such as LY, LM, LC and LK which were described above, and W, R, G, B, in consideration of the viscosity of each ink, a common suction pump 64 and a common flow conduit 66 may be applied combining the ink of the color of 1, and the ink of other colors as above-mentioned. In this case, the same effectiveness as the above is acquired.

[0072]

Furthermore, as for each recording head 2 and each subtank 3 concerning this operation gestalt, it is desirable to be thermally intercepted or insulated so that it may not be influenced of the temperature from printer 1 body or the open air. Or it shortens the makeup time of the printer 1 which heating takes, in order to reduce the loss of heat energy, while performing heat insulation with each recording head 2

and members other than each subtank 3, it is desirable to cover each recording head 2 and each subtank 3 by the member with small heat capacity.

[0073]

[Effect of the Invention]

According to this invention, the color mixture of the ink between each recording head at the time of a maintenance can be prevented.

[Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the ink jet printer concerning the gestalt of this operation.

[Drawing 2] It is the front view showing said ink jet printer.

[Drawing 3] (a) They are the sectional view showing the recording head concerning the gestalt of this operation, and the perspective view showing the heating heater arranged in the (b) aforementioned recording head.

[Drawing 4] It is the perspective view showing the attraction cap concerning the gestalt of this operation.

[Description of Notations]

A Main scanning direction

B The direction of vertical scanning

1 Ink Jet Printer

2 Recording Head

2a Regurgitation side

105 Nozzle

105a Delivery

3 SubTank

4 Carriage Device

4a Carriage

4b Guide member

6 Maintenance Unit

61 Attraction Cap (Cap Member)

62 Recovery Means

63 Wiper Member

64 Suction Pump

66 Flow Conduit

7 Home Position

71 Moisturization Cap

8 Maine Tank

9 Booster Pump

10 Ink Feed Zone Material

11 Platen

99 Record Medium

[Translation done.]

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61 Attraction Cap (Cap Member)

62 Recovery Means

63 Wiper Member

64 Suction Pump

66 Flow Conduit

7 Home Position

71 Moisturization Cap

8 Maine Tank

9 Booster Pump

10 Ink Feed Zone Material

11 Platen

99 Record Medium

[Translation done.]

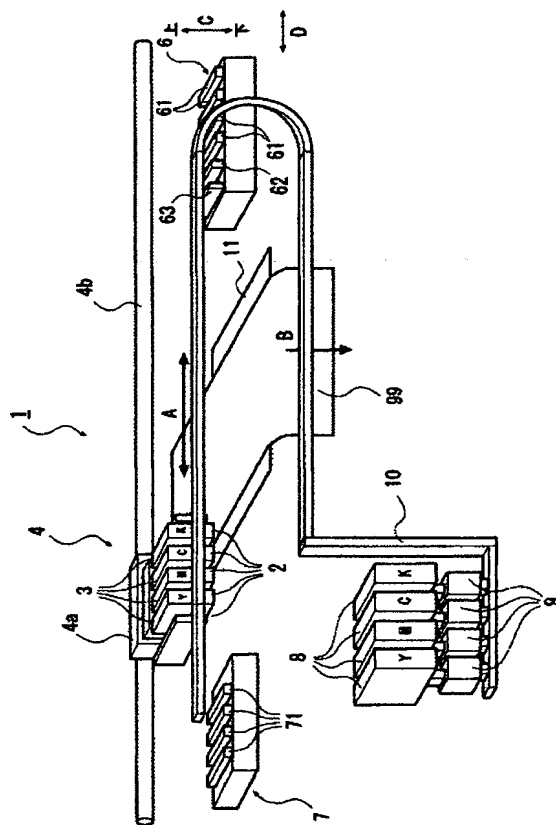
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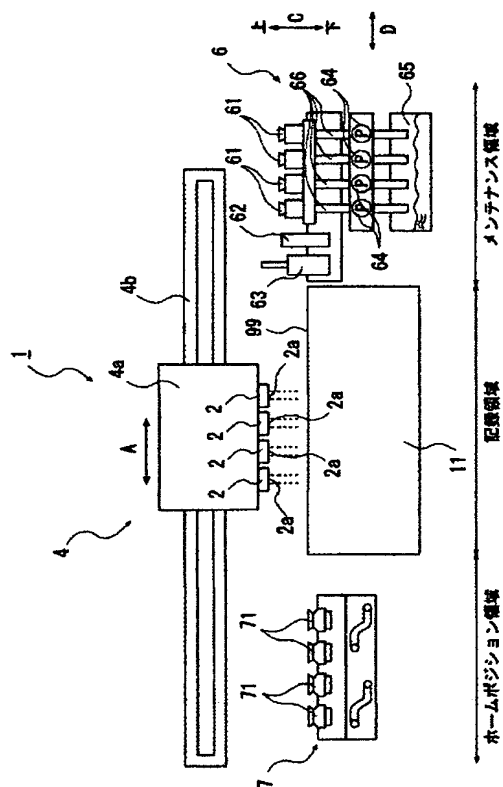
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DRAWINGS

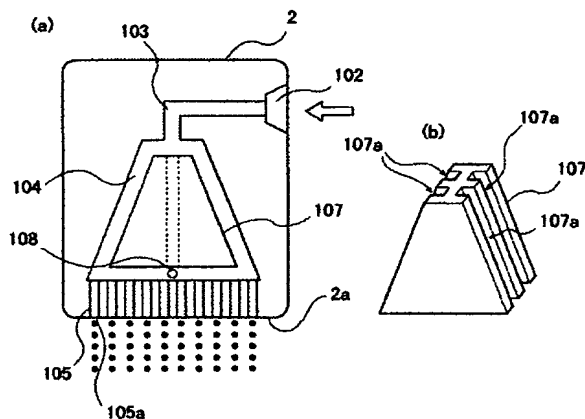
[Drawing 1]



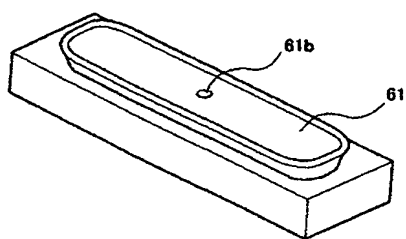
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]